

CLAIMS

What is claimed is:

- 1 1. An interconnect assembly comprising:
2 a substrate;
3 a contact element disposed on said substrate, a first portion of said contact
4 element adapted to be free-standing and further adapted to be capable
5 of moving from a first position to a second position when a force is
6 applied to said first portion of said contact element; and
7 a stop structure disposed on a second portion of said contact element, said stop
8 structure defining said second position.
- 1 2. The interconnect assembly as in claim 1, wherein a plurality of said contact
2 elements are disposed on said substrate, said contact elements disposed in a pitch
3 having a range of about 2.5 microns to 2000 microns.
- 1 3. The interconnect assembly as in claim 1, wherein said substrate has a bond
2 pad connected to a microelectronic device, said contact element disposed on said bond
3 pad.
- 1 4. The interconnect assembly as in claim 1, wherein said substrate has a re-
2 distributed conductor connected to a microelectronic device, said contact element
3 disposed on said re-distributed conductor.

1 5. The interconnect assembly as in claim 1, wherein said substrate has a bond
2 pad connected to a test equipment, said contact element disposed on said bond pad.

1 6. The interconnect assembly as in claim 1, wherein said contact element is
2 resilient and wherein said stop structure presses against said second portion with said
3 force when said force is applied to said first portion.

1 7. The interconnect assembly as in claim 1, wherein said contact element
2 comprises at least one metal layer.

1 8. The interconnect assembly as in claim 1, wherein said contact element
2 comprises a first metal layer and a second metal layer, said first metal layer providing
3 said contact element with resiliency and said second metal layer providing electrical
4 conductivity for said contact element.

1 9. The interconnect assembly as in claim 1, wherein said contact element is an
2 elongate resilient contact element.

1 10. The interconnect assembly as in claim 1, wherein said first portion of said
2 contact element is sloped relative to a surface of said substrate such that one end of
3 said first portion of said contact element is at a height above said surface of said
4 substrate.

1 11. The interconnect assembly as in claim 1, wherein a portion of said first portion
2 of said contact element protrudes at a height from a surface of said stop structure.

1 12. The interconnect assembly as in claim 11, wherein said height in which said
2 contact element protrudes from said surface of said stop structure is a predetermined
3 height.

1 13. The interconnect assembly as in claim 1, wherein said substrate comprises an
2 integrated circuit in a semiconductor material, and wherein said force is applied when
3 another contact element is brought into mechanical and electrical contact with said
4 contact element.

1 14. The interconnect assembly as in claim 1, wherein said contact element is a
2 resilient contact element and wherein said force is applied when another contact
3 element is brought into mechanical and electrical contact with said contact element and
4 wherein said force causes said resilient contact element to flex from said first position
5 to said second position and wherein said stop structure defines said second position
6 which defines a maximum flexing of said resilient contact element.

1 15. The interconnect assembly as in claim 1, wherein said first portion of said
2 contact element has substantially a triangular shape and a third portion of said contact
3 element being a point of said triangular shape.

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1 16. The interconnect assembly as in claim 1, wherein said stop structure has a
2 vertical height that is less than a vertical height of a shortest contact element that is
3 statistically likely to exist.

1 17. A method of forming an interconnect assembly, said method comprising:
2 disposing a contact element on a substrate, a first portion of said contact
3 element being free-standing and being capable of moving from a first
4 position to a second position when a force is applied to said first
5 portion of said contact element; and
6 disposing a stop structure on a second portion of said contact element, said
7 stop structure defining said second position.

1 18. The method as in claim 17, wherein disposing said contact element on said
2 substrate includes disposing another contact element on said substrate in a fine pitch.

1 19. The method as in claim 17, wherein said contact element is free-standing and
2 resilient.

1 20. The method as in claim 17, wherein disposing said contact element further
2 comprises:
3 applying a first masking layer on said substrate;

4 forming in said first masking layer, an opening extending into said first
5 masking layer, said opening having a tapered wall; and
6 depositing a metal layer on said tapered wall of said opening of said first
7 masking layer.

1 21. The method as in claim 20, wherein said tapered wall is tapered using at least
2 one technique of tapering by using a gradual scale, tapering by reflowing, tapering by
3 controlled exposure, tapering by varying a mask distance or tapering by multiple
4 exposures.

1 22. The method as in claim 20, wherein after forming said tapered wall, the
2 method further comprises:
3 placing a mask pattern over said first masking layer, said mask pattern having
4 a pattern substantially triangular in shape; and
5 depositing said metal layer in said opening of said first masking layer in said
6 substantially triangular shape according to said mask pattern.

1 23. The method as in claim 20, wherein depositing said metal layer includes using
2 one of a sputtering deposition process, an electroplating process, a chemical vapor
3 deposition process and an electroless plating process.

1 24. The method as in claim 20, wherein depositing said metal layer includes:

2 depositing a first metal layer, said first metal layer selected for its resilient
3 property; and
4 depositing a second metal layer, said second metal layer selected for its
5 electrical conducting property.

1 25. The method as in claim 20, further comprising:
2 removing a portion of said first masking layer as to allow said contact element
3 to be free-standing; and
4 applying an additional layer as to cover said second portion of said contact
5 element.

1 26. The method as in claim 25, further comprising:
2 planarizing said first masking layer to form said stop structure, said stop
3 structure having a vertical height less than a vertical height of a shortest
4 contact element that exists.

1 27. The method as in claim 20, further comprising:
2 removing said first masking layer;
3 applying a second layer over said second portion of said contact element and
4 allowing said first portion of said contact element to be free-standing.

1 28. The method as in claim 27, further comprising:

2 planarizing said second layer to form said stop structure, said stop structure
3 having a vertical height less than a vertical height of a shortest contact
4 element.

1 29. The method as in claim 17, wherein said contact element is a resilient contact
2 element which is free-standing and wherein said force is applied when another contact
3 element is brought into mechanical and electrical contact with said contact element and
4 wherein said force causes said resilient contact element to flex from said first position
5 to said second position and wherein said stop structure defines said second position
6 which defines a maximum flexing of said resilient contact element.

1 30. The method as in claim 17, wherein said contact element is a resilient contact
2 element which is free-standing and wherein said stop structure presses against said
3 second portion with said force when said force is applied to said first portion and
4 wherein said force is applied when another contact element is brought into mechanical
5 and electrical contact with said contact element.

1 31. An electrical system comprising:
2 a first substrate having a first contact element;
3 a second substrate;
4 at least one second contact element disposed on said second substrate, a first
5 portion of said second contact element adapted to be free-standing and
6 further adapted to be capable of moving from a first position to a

7 second position when a force is applied to said first portion of said
8 second contact element by said first contact element; and
9 a stop structure disposed on a second portion of said second contact element,
10 said stop structure defining said second position.

1 32. The electrical system as in claim 31, wherein said second substrate has a bond
2 pad connected to a microelectronic device, said second portion of said second contact
3 element disposed on said bond pad, and said first substrate is one of (1) a test probe
4 assembly having said first contact element to make contact with said second contact
5 element and (2) a package having said first contact element to house said
6 microelectronic device during use of said microelectronic device.

1 33. A method for forming a freestanding, elongate resilient contact element, said
2 method comprising:
3 depressing a mold into a deformable material, said mold determining a shape
4 of at least a portion of said freestanding, elongate resilient contact
5 element;
6 forming at least said portion of said freestanding, elongate resilient contact
7 element on said deformable material.

1 34. A method as in claim 33 wherein said forming comprises depositing a
2 conductive material on said deformable material after said deformable material has
3 been deformed with said mold.

1 35. A method as in claim 34 wherein said mold comprises a plurality of shapes for
2 a corresponding plurality of portions of freestanding, elongate resilient contact
3 elements.

1 36. A method as in claim 35 further comprising:
2 removing said deformable material after depositing said conductive material.

1 37. A method as in claim 36 wherein said freestanding, elongate resilient elements
2 are disposed on corresponding electrical interconnect pads on a substrate.

1 38. A method as in claim 37 wherein said substrate comprises a semiconductor
2 integrated circuit.

1 39. A lithographically formed resilient contact element having a curved beam
2 portion which extends upwardly from a substrate and which is lithographically
3 defined.

1 40. A lithographically formed resilient contact element as in claim 39 further
2 comprising:
3 a base portion attached mechanically to said substrate and electrically coupled
4 to an electrical interconnection terminal on said substrate, and wherein

5 said resilient contact element is freestanding when released after being
6 initially formed.

1 41. A lithographically defined resilient contact element as in claim 40 wherein a
2 curve of said curved beam portion extends upwardly away from said substrate and
3 said curve is lithographically defined by a curved slope in a sacrificial layer which is
4 removed to release said resilient contact element.

1 42. A lithographically defined resilient contact element as in claim 40 further
2 comprising a sacrificial layer which defines a curve of said curved beam portion.

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